Evidence-based anatomical review areas derived from systematic analysis of cases from a radiological departmental discrepancy meeting

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Introduction

Error is an inevitable accompaniment of complex systems involving human input. As such, it is generally accepted that errors arise commonly during the performance and reporting of radiological examinations, with a recent meta-analysis of fifty eight discrepancy studies showing a pooled discrepancy rate of 7.7%.[1] The most common types of reporting error are false negative reports and misinterpretations, and these are most frequently encountered with computed tomography (CT) examinations.[2–4]Certain types of error are especially common and feature repeatedly during discrepancy meetings; it has been suggested that awareness of these specific errors may improve reporting accuracy.[5, 6]

In the UK, the Royal College of Radiologists (RCR) has encouraged radiologists to participate in meetings in which cases involving radiological errors are discussed, and guidance on the conduct of these meetings has been published.[7–9] Recently, the RCR launched the Radiology Events and Discrepancies (READ) project, which aims to create educational material based on nationally submitted radiological errors.

Reduction in error rates can also be achieved following establishment of a departmental discrepancy review meeting.[10] Retrospective analysis of cases in which error is felt to have arisen has educational benefit. An appreciation of the error along with identification of possible causal factors allows modification of departmental practice, radiological technique or reporting behaviour such that similar errors might be avoided in the future.[7, 11] Meeting participation can also be used as part of appraisal and revalidation discussion.[7] Ultimately, these

measures would hopefully help ensure improvement in patient safety and optimisation of patient care.[12–14]

The concept of the "checklist" or "review areas" when reporting chest radiographs is familiar to all radiologists. These short lists of specific anatomical review areas are readily incorporated into routine practice and ultimately become second nature. A growing body of evidence indicates that checklists, such as the World Health Organization Surgical Safety checklist, may help to reduce medical error caused by human factors.[1, 15] We set out to produce short checklists of specific anatomical review sites for different regions of the body based on the frequency of radiological errors reviewed at our discrepancy meetings, thereby creating "evidence-based" review areas for radiology reporting.

Methods

This study received local ethical board waiver**.** Our institution is an 855-bed university teaching hospital in Eastern Scotland, serving a catchment population of 450,000 with additional responsibility for reporting images from affiliated ambulatory diagnostic and treatment centres. The teaching hospital covers all medical and surgical specialities except cardiothoracic and transplant surgery. All consultant radiologists contribute to general radiology work whilst maintaining complementary specialist interests. With the exception of ultrasound (US) (the majority of which is performed and reported by trained sonographers), most of the imaging workload is reported by consultant radiologists, sometimes with input from trainees. Senior trainees independently report some US examinations, radiographs and a minority of CT examinations.

Discrepancies and errors are referred by the radiologist who encountered them, to a chairperson who presents them at a monthly discrepancy meeting. This retrospective analysis is based on documented records from these meetings from 2007 to 2012.

Errors were identified from several sources: detection during the reporting of subsequent imaging examinations; identification during image review at multi-disciplinary team meetings; and following direct feedback from clinicians.

Not included in the aforementioned meetings are errors within breast imaging and interventional procedures, which are discussed in their own respective meetings.

All of the discrepancies discussed at the meeting are recorded in a spreadsheet detailing the modality, examination, error, and classification of the error. Error classification is based on a modified version of that described by Renfrew et al. which divides errors as follows[5]:

- **Observational errors**, subdivided into:
    - *Perceptual errors*
        - False positive - identifying an abnormality which was not present.
        - False negative - failing to recognise an abnormality.
    - *Classification errors* which arose when an abnormality was identified but was misinterpreted, e.g. a metastatic deposit being described as a cyst.
- **Communication errors** included clerical errors, report transcription errors, patient misidentification, information technology problems, and inadequate liaison between radiologist and referring clinician
- **Technical errors** included those where poor imaging technique or inappropriate modality selection leading to an observational error.

Results

Overall

A total of 561 errors of all types were encountered in relation to 477 patients. One hundred and seventy errors were categorised as involving two body areas. The majority of the errors were due to misinterpretation (n= 513, 91.4%) and the most common imaging modality in which errors occurred was CT followed by plain radiographs (Table 1 and 2). It was found that five or fewer anatomical sites accounted for more than 50% of observational errors in all body systems. For each of the body regions, with the exception of chest, a table has been created demonstrating the site and type of observational errors.

Chest

Ninety-nine errors occurred in the chest region, with CT imaging contributing to the most errors (n=58, 58.6%) followed by chest radiographs (n=39, 39.4%) (Table 2). Of the 92 observational errors, missed findings (n=68, 73.9%) were by far the most common, followed by misclassification (n=18, 19.6%) and false positives (n=6, 6.5%).

Pulmonary nodules are the most commonly missed lesion in both radiographs (15) and CT (14) (Table 3 & 4). Figure 1 demonstrates the distribution of the missed pulmonary nodules or lesions on chest radiographs and chest CTs. Missed pulmonary lesions ranged in size from 1mm to 52mm (mean 28mm) in

diameter on radiograph and 2 to 64mm (mean 13mm) in diameter on CT. Bone lesions were also quite commonly missed in CT examinations (10) and radiographs (9) (Table 3 & 4). Additionally we found ten cases of missed pulmonary thromboembolism in CT examinations (Table 4). In summary, we found that the top five review areas for the chest region would be lung bases on CT examinations (14), apices on chest radiographs (15), bone (19), vasculature (12) and the mediastinum (8).

Abdominopelvic

Two hundred and ninety errors occurred in the abdomen and pelvis with CT being the greatest source of errors (n=206, 71.0%) and US being the second most common (n=41, 14.1%) (Table 2). Observational errors were again the most common, accounting for 261 (90.0%) discrepancies. The majority of observational errors were missed findings (n=184, 70.5%), while 56 (21.5%) were misclassification and only 21 (8.0%) were false positives.

The five most common areas for discrepancies were: kidneys (31); colon (31); vasculature (31); liver (29) and pancreas (20) (Table 5).

Central nervous system (CNS)

One hundred and sixteen errors occurred in the CNS where CT was the most common source of errors (58.1%) and magnetic resonance imaging (MRI) was the second most common, accounting for 43.6% (Table 2). One hundred and ten

(94.8%) errors were observational. False negatives accounted for 90 of the 110 observational errors (81.8%), while 16 (14.5%) were misclassification and only 4 (3.6%) were false positives.

The five most common regions in which observational errors were detected were: vasculature (22); peripheral cerebral grey matter (11); bone (10); parafalcine (8); and the frontotemporal lobes surrounding the Sylvian fissure (7) (Table 6). Of the vascular discrepancies, 12 occurred within the arteries and 10 within the venous structures. The total number of errors from these areas accounted for more than half of all the total errors (58 out of 110; 52.7%).

MSK

Of the 125 MSK discrepancies, single errors were observed in 100 patients and two or more errors were present in 11 patients. The most common imaging modality where errors occurred is plain radiographs (45.6%) followed by CT imaging (34.4%) as displayed in Table 2. 120 (96.0%) were observational, of which there were 98 false negatives (81.7% of the total observational errors), 19 misclassifications (15.8%) and 3 false positives (2.5%). Sixty-eight (54.4%) errors were identified in the axial skeleton (AxS), 42 (33.6%) in the appendicular skeleton (ApS) and 15 (12.0%) affected the soft tissues. The top five most common sites of error were all within the skeleton, with 65.6% of MSK errors identified within 5 skeletal sites. These were, in descending order: spine (45); thoracic cage (12); pelvis (11); sacrum (7) and calvarium (7) (Table 7).

Ninety-five (96.5%) of MSK system errors were observational, of which false negative errors were again the commonest type, accounting for 78.4% (n=98) of discrepancies. The most common of these were: missed metastases (n=35, 47%); overcalling of metastatic lesions in those with known primary non-bony malignancy (n=12, 16%); and missed fractures (n=7, 9%).

Discussion

For the purpose of our study we have classified errors according to anatomical region. By contrast, in the Radpeer process (an initiative by the American College of Radiology) radiological errors are categorised according to perceived clinical importance by a second reader.[12] However grading errors by clinical importance is itself entirely subjective, with identical errors being associated with different levels of clinical importance depending on the overall clinical scenario. Inter-reader agreement for categorisation of errors by clinical importance in the Radpeer process is poor, with similarly poor agreement within other proposed scoring systems.[13, 14] The value of grouping errors by clinical importance is a contentious matter regardless of the validity and reliability of any such categorisation. More importantly, categorising errors by clinical significance does not provide radiologists with any tips or tricks which might help them to avoid making the same error again. The approach described in the current study, categorising errors by anatomical site, is comparatively objective. Using checklists of this type, radiologists can take an educated quick “second look” before they finally sign off an imaging study report. A meta-analysis performed by

Wu et al. has demonstrated that there were differences in the rate of discrepancies depending on the body region which reinforces our reasoning for creating custom review areas according to body regions.[1] Table 8 summarises the review areas according to the four body regions we have scrutinised.

Chest

Pulmonary nodule detection remains a challenge and accounts for approximately one-third of all of our missed findings on chest radiograph and CT, in keeping with findings from previous studies.[15] Overlying anatomical structures, for example ribs, are a more significant factor than the actual anatomical position of missed nodules on a chest radiograph.[16] The perihilar and retrocardiac regions and lung apices are important but somewhat less common sites of overlooked pulmonary lesions on chest radiographs in our series, which indirectly suggests the validity of existing common review areas.

Although 60% of malignant nodular lesions are in the upper zones, we found that missed pulmonary nodules on CT were predominantly in the lower zones, similar to the results published by White et al (Figures 1).[17, 18] The reason for this is unclear but it serves as a reminder that lung bases should be carefully examined. Interestingly, all of the missed pulmonary nodules were on thick slice CT (5mm) rendering the coronal and sagittal reformation images with Multi-Planar Reconstruction (MPR) suboptimal. The use of Maximum Image Projection (MIP) (compared with standard 1mm or 5mm axial images) can aid in the detection of pulmonary nodules smaller than 5mm, which is the size of the majority of missed nodules.[19] Importantly, although discrepancies included ‘missed’ pulmonary

lesions measuring 1mm, some radiologists may, reasonably, not mention these lesions as current guidelines state that follow up examination is only needed for lesions measuring 4mm or more.[20]

All of the missed pulmonary thromboemboli were found to be on CT staging examinations. Although assessment of the pulmonary arteries may be suboptimal due to the enhancement phase, obvious pulmonary thromboemboli should not be missed.

Bone lesions are the second most common interpretative error on both chest radiographs and CT imaging. Almost 80% of patients with multiple myeloma will have radiological evidence of skeletal involvement which could be seen on the chest radiograph.[21] However, there is significant underestimation in diagnosis as the false negative rate on plain radiography is high (30-70%).[22] Another major discrepancy on chest radiograph and CT was missed bone metastasis, which is discussed further under the MSK heading.

Abdominopelvic

The vascular tree, colon, kidneys, liver and pancreas accounted for over 50% of all perceptual discrepancies. Horton et al. listed ten different review areas (*gastric lesions, biliary disorders, pancreatic masses, renal masses, small bowel masses, mesenteric and renal vascular pathology, spine disorders, soft tissue lesions, adrenal masses and pulmonary emboli*) but only 51% of our discrepancies occurred in these areas compared to 52% in our five suggested review areas.[6] The discordance is most likely due to the anecdotal nature of the

previous article, as misses in unusual locations such as the stomach or soft tissue lesions are more memorable.

'Satisfaction of search' is where the detection of one radiographic abnormality satisfies the 'search for meaning', thus causing premature termination of the assessment (Figure 2). As such, complex manifestations of the patient's disease may result in incomplete assessment of the examination; Donald *et al* reported 17 of 558 errors due to satisfaction of search.[3, 23]

While reviewing the discrepancies, it became apparent that the abnormality was frequently better appreciated on multiplanar reformats (MPRs) than on the standard axial imaging (Figure 3). In the era of spiral CT and MPR reconstruction, review of sagittal and coronal images should be routine in every CT examination. This is supported by numerous studies showing the increased diagnostic accuracy using MPR compared to the review of only axial images.[24–28]

CNS

As with abdominopelvic and chest imaging, vascular discrepancies formed a significant contribution to total errors (Figure 4). This is not surprising given that most CT or MRI exams are not optimised to detect vascular anomalies. However, carotid arterial dissections and large aneurysms can be seen on both CT and MRI without contrast, as can venous sinus thrombosis.[29, 30] One possible source of underlying error may be the 'edge of film' phenomenon, with

superior sagittal sinus thrombosis frequently only seen on the top slices of the axial images, and internal carotid or vertebral dissection only being visible in the bottom few slices. Another likely reason for the number of vascular discrepancies is that the vascular tree is often only scrutinised when a specific diagnosis is queried. This is supported by a study showing that detection of ICA dissection improved from 23% to 77% when arterial review became incorporated in routine review on standard non-angiographic MRI sequences, even in inexperienced viewers.[31]

Unsurprisingly, peripheral grey matter lesions accounted for a high number of discrepancies given the complex and convoluted course of the grey matter (Figure 5). One study showed an increase in sensitivity from 57% to 71% for the detection of stroke on CT using a level centred at 32 Hounsfield units (HU) with a width of 8 HU.[32] Other authors have also suggested the benefit of reviewing CT on a ‘stroke window’ of 40 HU as the level centre with a width of 40 HU for a multitude of pathologies affecting both grey and white matter.[33] On a similar theme, bone review also benefits from appropriate windowing and in the context of trauma, separate bone reconstructions using a high spatial frequency reconstruction algorithm are useful for subtle fracture detection.[34]

Misclassifications in the frontotemporal parenchyma surrounding the Sylvian fissure were noted by the authors to be so common that we felt this warranted separation into its own group. The difficulty of diagnosis in this region cannot be overstated and is largely a result of the complex multiplanar anatomy further complicated by the number of pathologies that frequently occur here in their

earliest form, such as the subtle insular ribbon sign, early oedema or the loss of the Sylvian fissure indicating subarachnoid haemorrhage.

The use of MPR has been mentioned previously and would also render the “edge of film” misses null and void as the edge of a series on one plane often becomes the centre of the series on another plane. Similar benefits should be seen in the parafalcine region, the final region of common observational error. This results from the close approximation of cerebral hemisphere, falx cerebri, corpus callosum and perifalcine vessels. From our experience, the discrepancies were more easily appreciated on coronal or sagittal reformats than on the original axial images.

MSK

MSK errors accounted for nearly a quarter of total discrepancies recorded in our database, and like the other anatomical categories, primarily consist of observational misses. The high prevalence of MSK discrepancies can be attributed to the inherent inclusion of the skeleton and soft tissues in all imaging examinations, regardless of modality or primary organ of interest.

The AxS is imaged at least partly in all CT examinations regardless of clinical indication. In our series, the chief CT error in the AxS was failure to perceive bone metastases, which accounted for 47% of AxS CT discrepancies. Whilst bone metastases are common in patients with known malignancy, their distribution is unpredictable and they tend to be overlooked, as importance is

placed on the known primary cancer and its visceral/nodal involvement. Anecdotally, many radiologists only review the skeleton after other key areas have been assessed and such 'satisfaction of search' may divert attention from subtle skeletal lesions.

At the same time, 12 of the 19 misclassification involved mistaking a benign lesion for metastatic disease in patients with known primary malignancy. This demonstrates a powerful bias introduced by clinical history (Figure 6). Both the beneficial and detrimental effects of prior history have been previously studied in a paper by Leslie et al. in which radiologists were asked to provide an initial review of images without the clinical information.[35]

Limitations

Several sources of bias apply to the generation of the error dataset used in this study. A large number of errors will not be reviewed at a discrepancy meeting and there are numerous reasons for this. Many errors may never be discovered. The decision to refer an error for discrepancy meeting review is entirely subjective and this is a major source of bias. However, from our experience, the decision to discuss an error during these meetings is typically based on the error's perceived clinical importance and/or educational value. We believe that these are reasonable filters to apply and it could be argued that their effect is to strengthen the quality of our case-mix as they will bias towards clinically significant errors, and downplay insignificant incidental findings.

We did not attempt to formally assess the clinical importance of errors. It is our opinion that the consequence of an error is influenced hugely by the clinical context in which it occurs. This means the same error can have profoundly different clinical impacts depending on the occasion when it is made. For example a missed bone metastasis in a patient who undergoes major surgery with curative intent has significantly greater implications than a missed bone metastasis in a patient with known liver, lung and brain metastases. Secondly, retrospective review of an error cannot replicate the reporting environment in which the error arose. Perception of the error at these later stages can also be biased by the availability of more clinical history or additional imaging. Furthermore, as mentioned previously, the importance of an error is subject to the experience, expertise and prejudice of the individual grading it.[14, 36] However, despite these shortcomings this is the first systematic evaluation of the anatomical pattern of errors. Further work will be required to determine whether implementation of these review areas will result in a reduction in errors. Indeed, it may be possible in future, through the use of review systems such as Radpeer, to produce a more personalised approach to the generation of specific review areas based on the long-term systematic collection of reporting data.

Conclusion

Radiological errors are common; through collection and analysis of these we can potentially reduce future errors and improve patient experience and safety through more accurate diagnosis. Our study found that for each body system, only five anatomical locations accounted for over 50% of perceptual errors. This finding suggests an avenue for focused image review before concluding an

imaging report. We feel that brief, targeted review using evidence-based review area checklists has the potential to maximise the use of the limited time available to the reporting radiologist.

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Figures:

Figure 1: CXR on the left- red circles shows the distribution of missed pulmonary nodules while the yellow circles mark sites of misclassification. Series of CT images on the right- blue circles shows the size and location of the missed pulmonary nodules while the red circles mark the size and location of misclassified nodules.

Figure 2: Image A shows a cystic lesion in the body of the pancreas (arrow) in a 63F with vague abdominal pain. However, this lesion distracted the radiologist from the large pancreatic tail mass (circle). In contrast, in image B, the pancreatic tail mass was correctly identified, but described as a malignant mass despite the active pancreatitis the patient had. Image C shows frontal sinusitis and right frontal cortical breach (arrow). However the subtle left parafalcine collection (arrow heads) was missed (image D).

Figure 3: Image A &B are of a patient presenting with suspected aortic dissection. On image A, the subtle irregularity of the renal cortex is perceptible, but the well-defined mass (arrow) is easily appreciable on the coronal reformats (image B). Image C shows several abnormal lymph nodes in the ileocaecal nodal chain (arrow heads). The subtle colonic wall thickening was missed, and on the axial images is extremely subtle, however on subsequent coronal reformats, is far more evident (circle, image D). HIV positive patient presenting with flank pain radiating to the lower abdomen was correctly identified as having normal kidneys with no calculi (image E), however the extensive periaortic fat stranding was overlooked (circle, image F). Subsequent CT angiogram performed several days later show this is to be secondary to multiple mycotic aneurysms (image G).

Figure 4: Patient with severe pancreatitis had a splenic pseudoaneurysm (arrow, image A) overlooked on a follow-up CT performed to monitor an upper abdominal collection for which he had recently had a drain inserted. The misplaced drain which lies curled within the colon (arrowhead, image A) was also overlooked. Both these errors came to light two days later when the aneurysm ruptured (circle, image B) with the active extravasation presenting as torrential haematochezia. Image C and D shows a patient with extensive cortical oedema within the left insula and frontal lobe, however the left internal carotid artery dissection was missed (image E), meaning this was described as encephalitis rather than a middle cerebral artery infarction. Image F and G shows pre and post contrast CT in a patient being staged for malignancy demonstrate symmetrical internal carotid artery aneurysms that were missed. Symmetry can be the bane of the non-specialist.

Figure 5: Patient presenting with acute onset right sided weakness. The left cortical infarct was overlooked (circle). While subtle on standard windows, this becomes more obvious on narrower ‘stroke’ windows, and even more pronounced when multiplanar reformats are used.

Figure 6: Image A is that of a patient with gastric cancer with vertebral changes (arrows) described as metastases. In comparison image B is of a patient with sepsis and abdominal pain radiating to the back where the lytic end plate lesion was missed (arrowhead). Compare the well-defined sclerosed borders of image A, consistent with degenerative Schmorls nodes, with the lytic end plate lesion in image B. Image C shows the subsequent MRI showing marked progression of the spinal infection 6 weeks later. Image D to F are of an unrelated patient with progressive neck pain and a clinical history of ‘known fibrous dysplasia of C2’,

noted from a clinic letter from another institution. The plain film, CT and MRI were all reported as demonstrating findings consistent with known fibrous dysplasia despite the involvement of C3 (arrow, image E) seen on CT and MRI and extensive soft tissue component seen on MRI (arrowhead, image F).

Table 1: Errors divided by type and body area

	FN	FP	Misclassification	Technical	Communication	Total
Chest	68	6	18	2	5	99
Abdomino pelvic	184	21	56	9	20	290
CNS	90	4	16	1	5	116
MSK	98	3	19	2	3	125
Total*	381	28	104	13	35	561

*Some errors fall into two body systems. The total removes these duplications

FN= false negative; FP= false positive

Table 2: Division of errors by modality and body region.

	Plain radiographs	CT	MRI	Nuclear Medicine	US	Fluoroscopy	Total
Chest	39	58	1	0	0	1	99
Abdominopelvic	11	206	19	0	41	13	290
CNS	0	68	48	0	0	1	116
MSK	57	43	21	2	2	0	125
Total*	103	318	81	2	43	14	561

*Some errors fall into two body systems. The total removes these duplications

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537 **Table 3:** Chest radiograph – interpretative errors by region

Chest radiograph	FN	FP	Misclassification	Total
Pulmonary nodule	13	0	2	15
Bone lesion	9	0	0	9
Mediastinal mass	3	1	1	5
Lobar collapse	2	0	2	4
Hilar mass	2	0	0	2
Cardiac abnormality	0	0	1	1

538 *FN= false negative; FP= false positive*

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Table 4: CT chest – interpretative errors by findings

CT	FN	FP	Misclassification	Total
Pulmonary nodule	8	1	5	14
Pulmonary thromboembolism	9	0	1	10
Bone lesion	10	0	0	10
Lymphadenopathy	3	0	2	5
Breast lesion	3	0	0	3
Mediastinal mass	0	1	2	3
Oesophageal abnormality	0	1	2	3
Subdiaphragmatic pathology	2	0	0	2
Vascular abnormality	0	1	1	2
Chest wall mass	1	0	0	1
Pulmonary interstitial change	1	0	0	1

FN= false negative; FP= false positive

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545 **Table 5:** Abdomen and pelvis- interpretive errors by region.

	FN	FP	Misclassification	Total
Colonic	22	4	5	31
Renal	23	0	8	31
Vascular	23	4	4	31
Liver	19	0	10	29
Pancreas	16	1	3	20
Bone	13	2	0	15
Lymph nodes	12	1	2	15
Biliary	9	2	1	12
Urinary tract	4	0	8	12
Gynae	2	1	8	11
Small bowel	9	0	2	11
Omental	8	0	1	9
Gastric	5	3	0	8
Bladder	4	1	0	5
Peritoneal	5	0	0	5
Adrenal	3	1	0	4

Joint	3	0	0	3
Oesophageal	0	0	2	3
Spleen	1	0	1	2
Testicular	0	0	2	2
Abdominal wall	1	0	0	1
Psoas	1	0	0	1
Total	184	21	56	261

546 *FN= false negative; FP= false positive*

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549 **Table 6**: CNS- interpretive errors by region

	FN	FP	Misclassification	Total
Vasculature	20	0	2	22
Peripheral cerebral grey matter	11	0	0	11
Bone	8	0	2	10
Parafalcine region	8	0	0	8
Frontotemporal lobe (peri-Sylvian fissure)	0	0	7	7
Brainstem	6	1	0	7
Pituitary	4	1	0	5
Frontal lobe	4	0	0	4
Orbits	4	0	0	4
Spinal extradural	2	0	1	3
Diffuse white matter	1	1	1	3
Foramen	3	0	0	3

Magnum				
Parietal lobe	2	0	1	3
Cerebellum	3	0	0	3
Intradural spinal	2	0	0	2
Third ventricle	1	1	0	2
Intervertebral disc	2	0	0	2
Periventricular region	1	0	1	2
Sulci region	2	0	0	2
Cerebrospinal fluid	1	0	0	1
Internal auditory meatus	1	0	0	1
Laryngeal	1	0	0	1
Middle ear	1	0	0	1
Occipital lobe	1	0	0	1
Prepontine cistern	1	0	0	1

Sphenoid wing	0	0	1	1
Total	90	4	16	110

FN= false negative; FP= false positive

552 **Table 7**: MSK- interpretive errors by region.

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	FN	FP	Misclassification	Total
BONES				
Spine	24	0	13	37
Thoracic cage	12	0	0	12
Pelvis	8	0	2	10
Calvarium	6	0	1	7
Sacrum	7	0	0	7
Knees	6	1	0	7
Facial	3	0	1	4
Feet	4	0	0	4
Hips	4	0	0	4
Scapulae	4	0	0	4
Shoulder	3	1	0	4
Wrist	4	0	0	4
Hands	1	0	1	2
Clavicles	1	0	0	1
Elbows	0	1	0	1
Legs	1	0	0	1
SOFT TISSUE				
Spine	6	0	0	6
Buttocks	2	0	0	2

Knees	0	0	1	1
Neck	1	0	0	1
Pelvis	1	0	0	1
Total	98	3	19	120

554 *FN= false negative; FP= false positive*

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557 **Table 8:** Review areas suggested according to body region

Region	Review areas	Percentage of total according to region
Chest	1. Lung bases on CT	
	2. Apices on CXR	29.3
	3. Bone	19.2
	4. Vasculature	12.1
	5. Mediastinum	8.1
Abdominopelvic	1. Vasculature	10.7
	2. Colon	10.7
	3. Kidneys	10.7
	4. Liver	10.0
	5. Pancreas	6.9
CNS	1. Vasculature	19.0
	2. Peripheral grey matter	9.5
	3. Bone	8.6
	4. Parafalcine	6.9

	5. Frontotemporal lobes (surrounding Sylvian fissure)	6.0
MSK	1. Spine	29.6
	2. Thoracic cage	9.6
	3. Pelvis	8.0
	4. Sacrum	5.6
	5. Calvarium	5.6

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